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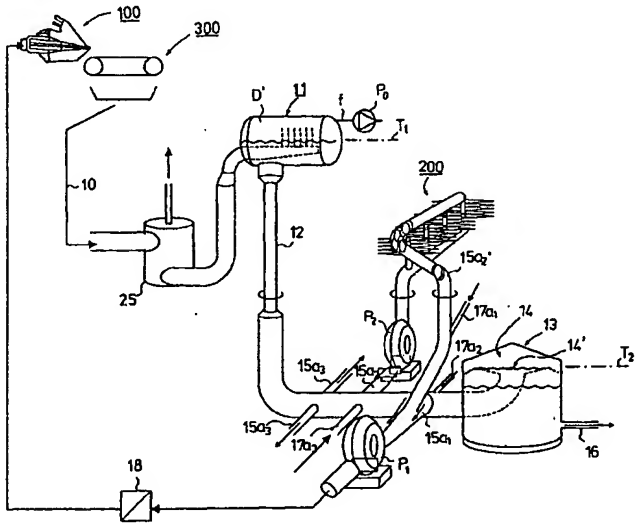
(54) **Title:** APPARATUS FOR PASSING STOCK INTO A HEADBOX OF A PAPER MACHINE OR EQUIVALENT



(57) **Abstract:** The invention relates to an apparatus for passing stock to a headbox (100) of a paper machine or equivalent. The apparatus comprises a deaeration tank (11) which is provided with vacuum by means of a vacuum pump (P_0) or another device. The deaeration tank (11) comprises an inlet duct (10) through which it is supplied with wire water. The deaeration tank (11) comprises a discharge duct (12) and, at the discharge end thereof, an overflow (14) for the wire water in the discharge duct (12). Said overflow (14) of the discharge duct (12) is located below the deaeration tank (11) and opens to a free air space, and that the discharge duct (12) includes a branch duct ($15a_1$) for a flow which is passed to the headbox (100).

WO 02/057542 A1

Apparatus for passing stock into a headbox of a paper machine or equivalent

The invention relates to an apparatus for passing stock to a headbox of a paper machine or equivalent.

When a deaeration tank is situated between centrifugal cleaning and a headbox feed pump in the short circulation, it should act not only as a means of removing air but also as a pressure equalizer before the headbox feed pump. However, the deaeration tank does not guarantee a constant pressure since, in the pressure conditions of the deaeration tank, air bubbles take a large part of its liquid volume. For example, 5 % of air takes 50 % of the liquid volume at a pressure of 0.1 atm. The foaming of air bubbles in the deaeration tank is unstable. The overflow from the deaeration tank evens out the surface but it pays no attention to whether there is air or gas in the liquid space of the deaeration tank. For this reason, the pressure after the deaeration tank varies. The pressure variations are transmitted to the headbox. The pressure control of the headbox attempts to maintain a uniform pressure in the approach pipe, but it affects the level of the surface in the deaeration tank, intensifying the disturbance. Mere removal of the overflow from the deaeration tank is not enough because the pressure variation turns into consistency variation.

In accordance with the invention, the deaeration tank can be accomplished without an overflow if it is in hydraulic connection with an overflow surface in the cellar. For example, the lock water part in a circulation water tank can act as an overflow surface if the deaeration tank is arranged to treat wire water in the short circulation. It is advisable to build the overflow so that it is wide. When short circulation dilutions, among other things, for the headbox feed and fan pumps are taken from a connecting pipe, the pressure of the short circulation

remains constant, because it is determined by a stable overflow at normal pressure, in which there is no problem caused by bubbling of air. In controlling the vacuum in the deaeration tank, turbo blowers may be more suitable than vacuum pumps. The process is simpler than before, consumes less energy and requires a considerably smaller process volume. When the flow of wire water increases, the speeds in the cyclone and in the spray tubes of the deaeration tank increase, which increases deaeration capacity.

Thus, in accordance with the invention, the deaeration tank is provided with an overflow which is disposed at the distance of the static height difference of the liquid column required by vacuum from the deaeration tank, for example, in the cellar space in the paper machine hall. The height difference between the liquid surface of the deaeration tank and the overflow surface is advantageously in a range of 5 to 10 m.

The back-pressure required by the pump is about 3-4 m counted as a static water column depending on the pump. The level of the overflow surface need not be controlled, i.e. it may be fixed, so that it is about 8 m below the surface of the liquid in the deaeration tank (8 m corresponds to a vacuum of 80 kPa in the deaeration tank). In that connection, it must be possible to adjust the vacuum level in the deaeration tank. The deaeration tank would then be located about 13 m above the cellar level, i.e. about 4 m above the machine level. The pressure loss in the spray feeding of the deaeration tank is about 3-5 m. When the pressure loss of the deaeration tank is added to the back-pressure of the pump, a level slightly lower than the machine level is achieved, which means that the waters coming from the wire can be treated with the system in question without additional pumping. The diameter of the distributor pipe is in a range of 0.3 to 2.0 m and the time in which the liquid flows from the deaeration tank to the biggest site of use is less than 2 minutes, in practice about 5 seconds.

Thus, the invention employs a deaeration tank which has no overflow, while, in accordance with the invention, the discharge duct of the deaeration tank comprises an overflow. The overflow is preferably disposed in a wire water tank or equivalent. In accordance with the invention, a branch duct / branch ducts is/are arranged to lead from the duct between the overflow of said discharge duct and the deaeration tank to a headbox, preferably to the suction side of a headbox feed pump.

The apparatus according to the invention provides a stock flow, which is uniform both in pressure and in consistency, to the suction side of the headbox feed pump and further to the headbox.

The apparatus for feeding stock to a headbox of a paper machine or equivalent is characterized by the disclosure in the claims.

The paper machine or equivalent is understood to mean printing paper, board, and soft tissue machines.

In the following, the invention will be described with reference to some advantageous embodiments of the invention illustrated in the figures of the appended drawings, to which the invention is, however, not meant to be exclusively confined.

Figure 1A shows a first advantageous embodiment of the invention. In the embodiment of the figure, a discharge duct of a deaeration tank is arranged to lead into connection with a tank such that the end of the discharge duct opens centrally in the tank and forms an overflow.

Figure 1B shows an embodiment of the invention comprising a discharge duct which is connected directly to a tank which comprises an overflow.

Figure 1C shows an embodiment of the invention including a tank which comprises two overflows, i.e. an overflow for a discharge duct and, in addition, an overflow for the surface level of the stock in the tank.

Figure 1D shows an additional embodiment of the invention.

Figure 1E is an axonometric illustration of the short circulation of stock in accordance with the invention in connection with a headbox of a paper machine, as well as of a centrifugal cleaning plant.

Fig. 1A shows a first advantageous embodiment of the invention which relates to a stock feed system of a headbox in a paper machine or equivalent and to its short circulation. Wire water is passed along a duct 10 into a deaeration tank 11, which has a discharge duct 12 for wire water from which air has been removed, and which discharge duct 12 comprises at its end an overflow 14, in which connection the height difference H_1 between the level T_2 of the overflow surface 14' of said overflow and the surface T_1 of the wire water in the deaeration tank 11 is in a range of 5 to 10 m. The deaeration tank 11 comprises for wire water an inside tank space D, which comprises a vacuum space D' above the liquid, into which space vacuum is drawn through a duct f by means of a vacuum pump P_0, an exhaust pump or another device and, at the same time, air is removed from the wire water. By the wire water is meant water that is removed from a paper web on the paper machine.

As shown in Fig. 1A, the discharge duct 12 is arranged to lead into connection with a tank 13 through its wall and upwards in the tank. The discharge duct comprises the overflow 14 which is located centrally in the tank, for example, in a wire water tank 13. Branch ducts $15a_3$, $15a_2$, $15a_1$ open into the discharge duct 12 of the deaeration tank, wire water and thick stock m being passed through the duct $15a_2$ of said ducts first to the suction side of a feed pump P_2 and further to a centrifugal cleaning plant 200, from which the stock mixture is passed through a

duct $15a_2'$ to a mixing point of the wire water passed from the branch duct $15a_1$ of the discharge duct 12, at which mixing point the stock mixture is diluted to a headbox consistency and passed to the suction side of a headbox feed pump P_1 and further to an inlet header J of a headbox 100. Dilution water is passed through the branch duct $15a_3$ to the thickness profiling system of the headbox of the paper machine. Advantageously, the connection points of the branch ducts are located in the discharge duct 12 close to the overflow 14 and, in the height direction, below the overflow 14.

The discharge duct 12 can thus in itself comprise an overflow 14, i.e. the lower end 12' of the discharge duct 12 is placed, as shown in Fig. 1A, centrally inside the wire water tank 13 and said end opens upwards to normal atmospheric pressure in the tank 13, in which connection a constant pressure prevails in the discharge duct 12. The end result, then, is the same as in the preceding case, .i.e. a constant pressure prevails in the discharge duct 12. Wire water/stock is passed by means of a pump P_4 to the deaeration tank 11. Wire water is passed through a duct 17 of the tank 13.

Fig. 1B shows an embodiment in which a discharge duct 12 of a deaeration tank is connected to the tank 13 itself, which comprises an overflow 14. The overflow 14 is formed such that the discharge duct 12 opens into the tank 13 from its side surface 13', in which case the tank 13 itself comprises the overflow 14 in its connection. The height difference between the overflow 14 and the surface level T of the stock in the deaeration tank is designated by H_1 in the figure. H_1 is in a range of 5 to 10 m.

Fig. 1C shows an embodiment in which a tank 13 comprises two overflows, i.e. an overflow 14 of a discharge duct 12 and, in addition, an overflow 140 which regulates the surface level of the stock in the tank 13 and, thus, the pressure prevailing in the tank. Wire water is circulated from the tank 13 by means of a pump P_4 along a duct 10 to a deaeration tank 11, and wire water from which air

has been removed is passed along the discharge duct 12 into the tank 13. The discharge duct 12 of the deaeration tank 11 is provided with a branch duct $15a_1$ for a headbox feed pump P_1, from which stock is passed further to an inlet header J of a headbox 100, and with a branch duct $15a_2$ for a feed pump P_2, from which stock is passed to a centrifugal cleaning plant 200 and further to the headbox 100 through a passage to the branch duct $15a_1$.

Fig. 1D shows an embodiment of the invention in which an overflow 14 of a duct 12 is formed such that the discharge duct 12 opens into a tank 13 from its side surface. The tank 13 comprises the overflow 14 for the liquid surface. Wire water from which air has been removed is passed through the discharge duct 12 to the tank 13. Wire water is pumped by means of a pump P_4 along a duct 10 into a deaeration tank 11, which is located in an elevated position with respect to the tank 13. The discharge duct 13 comprises, in the vicinity of the overflow 14 but at a lower level, branch ducts $15a_1$, $15a_2$, which comprise pumps P_1, P_2, in which connection stock is passed through the branch duct $15a_1$ to a headbox and through the branch duct $15a_2$ to a centrifugal cleaning plant 200 and further to the branch duct $15a_1$. Virgin stock m is added to the branch duct $15a_2$. Wire water is passed to the upper part of the tank 13 through a duct 17.

Fig. 1E shows an embodiment of the invention in which the wire water removed from a wire section 300 of a paper machine or equivalent is passed along a duct 10 into a cyclone 25 and further into a deaeration tank 11. The purpose of the cyclone is to remove air from wire water already before the deaeration tank 11 proper. The deaeration tank 11 having no overflow comprises a discharge duct 12 for air-free wire water, which discharge duct 12 ends in an overflow 14 at a lower level in a tank 13 in accordance with the invention. As axonometrically shown in the figure, the end of the discharge duct 12 is arranged to lead through a side wall 13' of the tank 13, and the end of the discharge duct 12 opens to a free air space and a normal air pressure inside the tank 13. Thus, in the duct 12, a constant pressure prevails in the air-free wire water. As illustrated in the figure, tubes $15a_3$

or ducts open from the branch duct 12 in a lower position in the vertical plane with respect to the overflow 14, through which tubes or ducts dilution water is passed, for example, to serve as headbox dilution water or as stock dilution water. In addition, as illustrated in the figure, thick stock m is passed through a duct $17a_3$ to the discharge duct 12 and, through a branch duct $15a_2$ situated on the opposite side, a mixture of wire water and thick stock m is passed from the duct 12 to the discharge duct $15a_2$ and further to a feed pump P_2, which feeds stock to a centrifugal cleaning plant 200. The mixture of wire water and stock is passed from the centrifugal cleaning plant 200 to a branch duct $15a_2'$, which is connected with a branch duct $15a_1$ branching from the discharge duct 12. The combined flow of stock and wire water is passed along the duct $15a_1$ to the suction side of a headbox feed pump P_1 and further through a machine screen 18 to a stock inlet header J of a headbox 100 of the paper machine. Additives/fillers or dilution liquid can be added through ducts $17a_1$ and $17a_2$ to the stock to be fed to the headbox. A duct 16 opens from the lower part of the tank 13 for passing wire water to the long circulation.

A duct f leads to the deaeration tank 11 from a vacuum pump P_0 or equivalent, by means of which vacuum is drawn into the interior space of the tank 11 and air released from wire water is removed from the tank space D'. In the deaeration tank, air is removed only from wire water. After that, the wire water is used at different locations, among other things, for dilution of stock. A cyclone-shaped device 25 is used before the deaeration tank, a centrifugal field being produced in said device to separate air in the form of bubbles, and there may be several cyclone-shaped devices 25 for different water fractions of the wire section. A flow duct is also used before the deaeration tank, the flow containing more air being separated from the upper part of said flow duct.

Claims

1. An apparatus for passing stock to a headbox (100) of a paper machine or equivalent, which apparatus comprises a deaeration tank (11) which is provided with vacuum by means of a vacuum pump (P_0) or another device, and the deaeration tank (11) comprises an inlet duct (10) through which it is supplied with wire water, **characterized** in that the deaeration tank (11) comprises a discharge duct (12) and, at the discharge end thereof, an overflow (14) for the wire water in the discharge duct (12), said overflow (14) of the discharge duct (12) being located below the deaeration tank (11) and opening to a free air space, and that the discharge duct (12) includes a branch duct ($15a_1$) for a flow which is passed to the headbox (100).

2. An apparatus according to the preceding claim, **characterized** in that the end of the discharge duct (12) forms the overflow (14).

3. An apparatus according to the preceding claim, **characterized** in that the discharge duct (12) is arranged to lead first downwards and in its end area upwards in the vertical direction, in which connection the end of the discharge duct (12) opens upwards to a free air space and to a normal air pressure.

4. An apparatus according to the preceding claim, **characterized** in that the discharge duct (12) is arranged to lead through a wall (13') of a stock and/or wire water tank (13) and it opens upwards inside the tank (13).

5. An apparatus according to the preceding claim, **characterized** in that the end of the discharge duct (12) opens in the tank (13) in a space above the liquid surface in the tank (13).

6. An apparatus according to claim 1, **characterized** in that the end of the discharge duct (12) is connected to a tank (13) and that the tank (13) comprises an overflow (14) for the wire water in the discharge duct (12).

7. An apparatus according to claim 1, **characterized** in that the lower end of the discharge duct (12) is arranged to lead inside a tank (13) and it opens to a free air space / air pressure and that, in addition, the tank (13) comprises a separate overflow (140), and that the tank (13) comprises a duct (10) leading to the deaeration tank (11), and that said duct comprises a pump (P_4) by which wire water is pumped into the deaeration tank (11).

8. An apparatus according to claim 1, **characterized** in that a branch duct ($15a_1$) is connected to the discharge duct (12) for passing thick stock (m) and wire water to the suction side of a headbox feed pump (P_2), stock being passed from the headbox feed pump (P_2) to the headbox (100) of the paper machine or equivalent.

9. An apparatus according to claim 1, **characterized** in that the discharge duct (12) comprises a branch duct ($15a_3$) for dilution liquid for passing dilution liquid into the headbox of the paper machine to different locations in the width direction of the headbox in order to accomplish dilution of the stock.

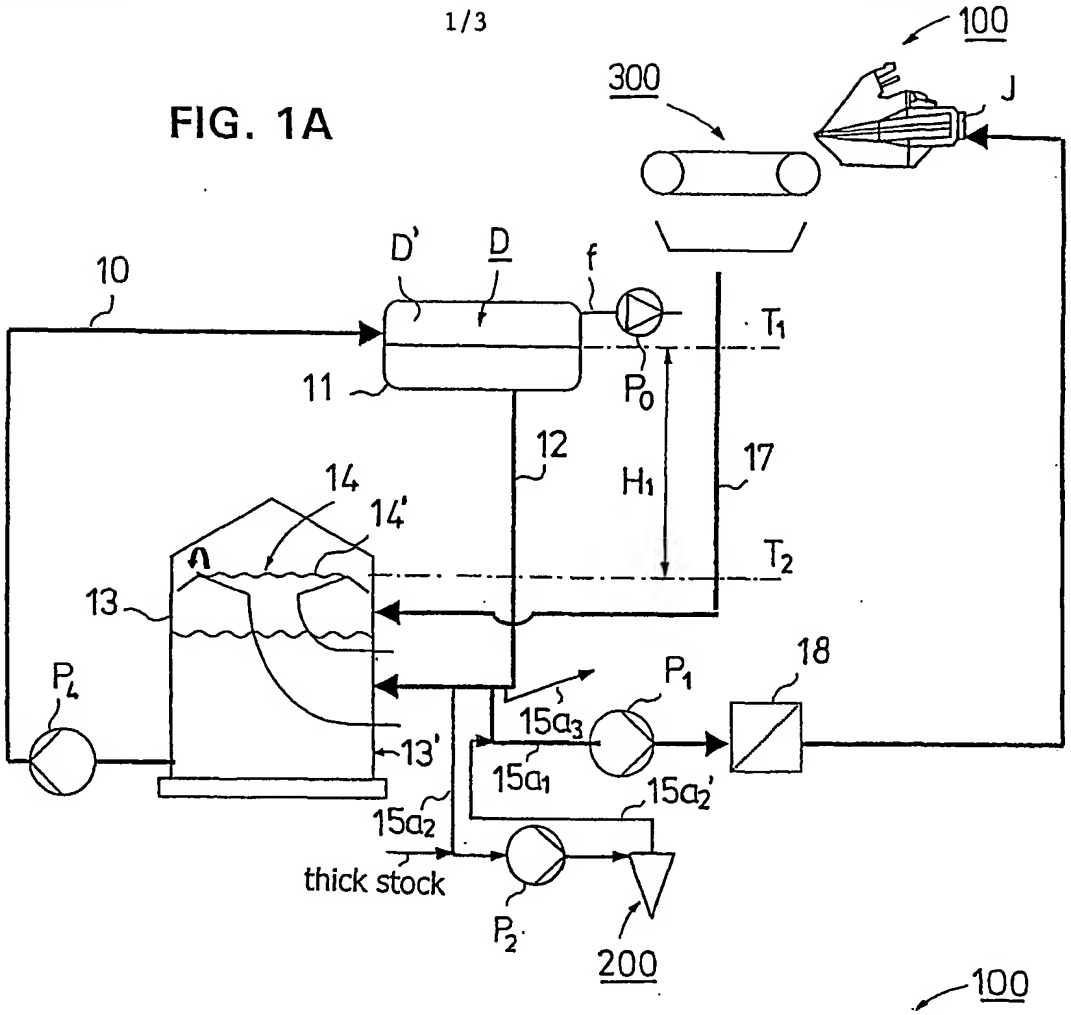
10. An apparatus according to claim 1 or 8, **characterized** in that the discharge duct (12) comprises a branch duct ($15a_2$), virgin stock (m) being added to the wire water in said branch duct and passed to the suction side of a feed pump (P_3) and further to a centrifugal cleaning plant (200) and from the centrifugal cleaning plant (200) to the branch duct ($15a_1$) and into the headbox (100).

11. An apparatus according to claim 1, **characterized** in that, before the deaeration tank (11), a cyclone-shaped device (25) is used in which a centrifugal field is produced to separate air in the form of bubbles, and there

may be several cyclone-shaped devices (25) for different water fractions of the wire section.

12. An apparatus according to claim 1, **characterized** in that a flow duct is used before the deaeration tank, the flow containing more air being separated from the upper part of said flow duct.

FIG. 1A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300
J
D'
D
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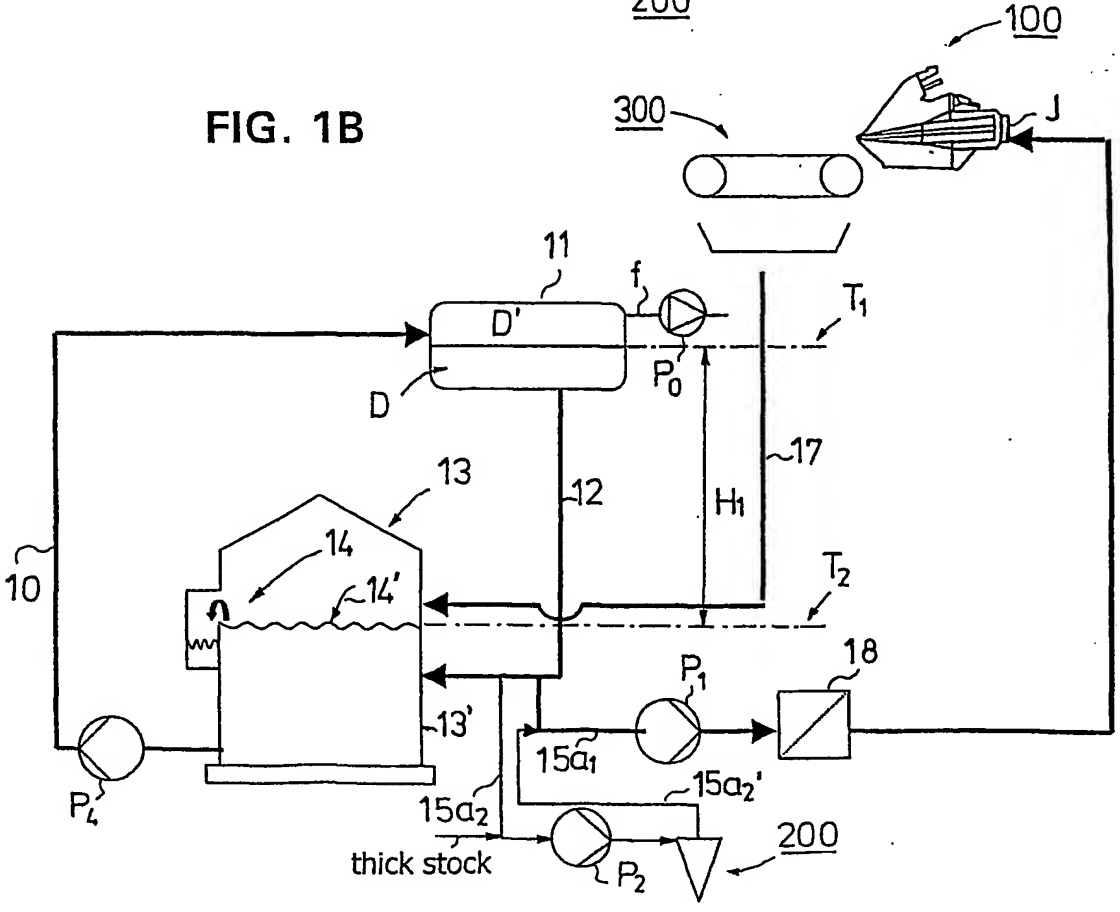
T1
11
P0
12
H1
17
14
14'
T2
13
P4
P1
18
15a3
13'
15a1
15a2'
15a2
thick stock
P2
200

FIG. 1B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15a1
15a2'
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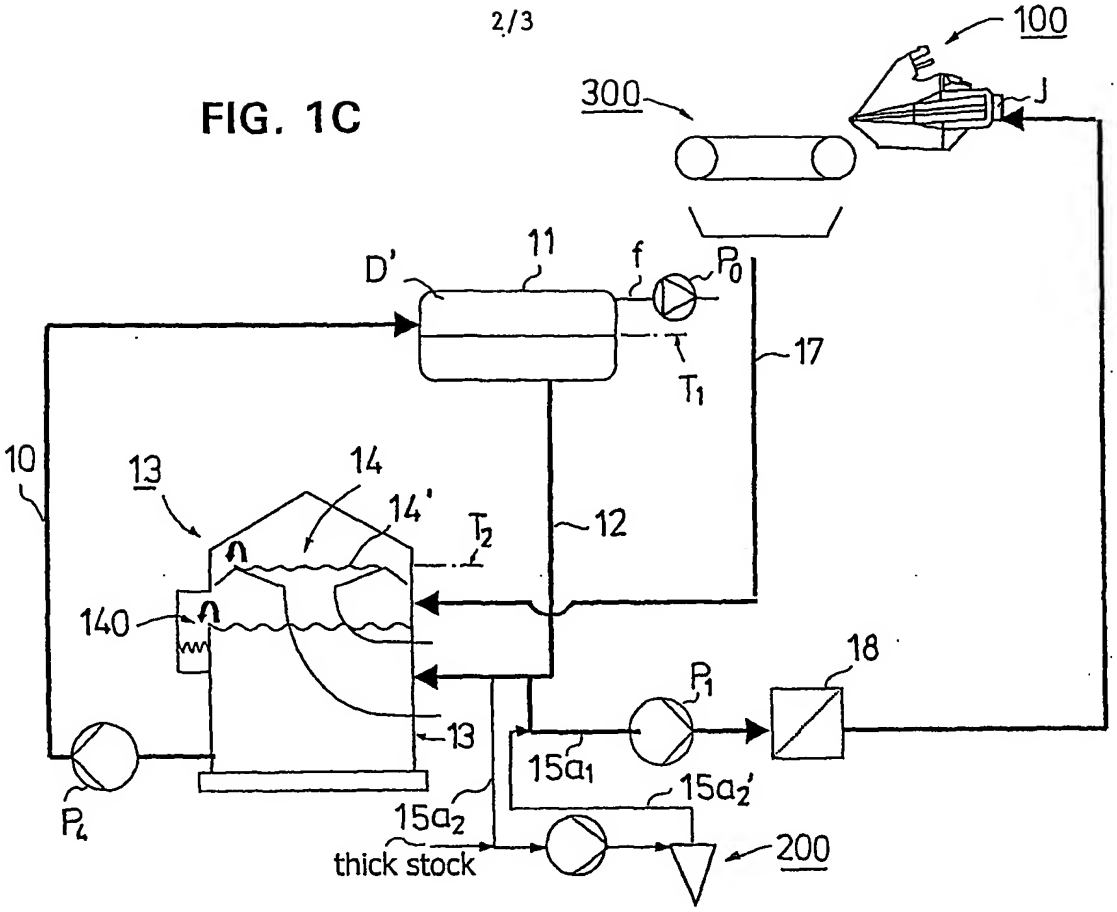
15a2
200
thick stock
P2

FIG. 1C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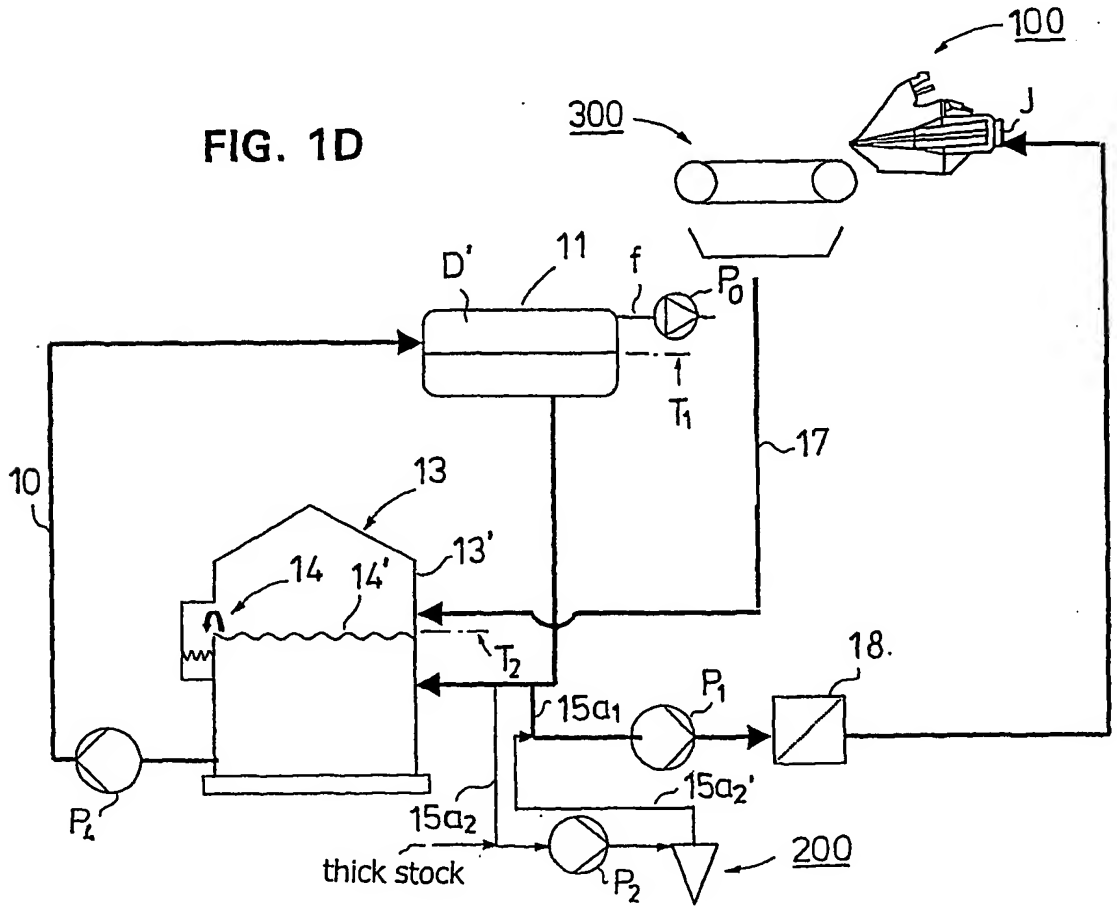
P_4
$15a_2$
thick stock
200

FIG. 1D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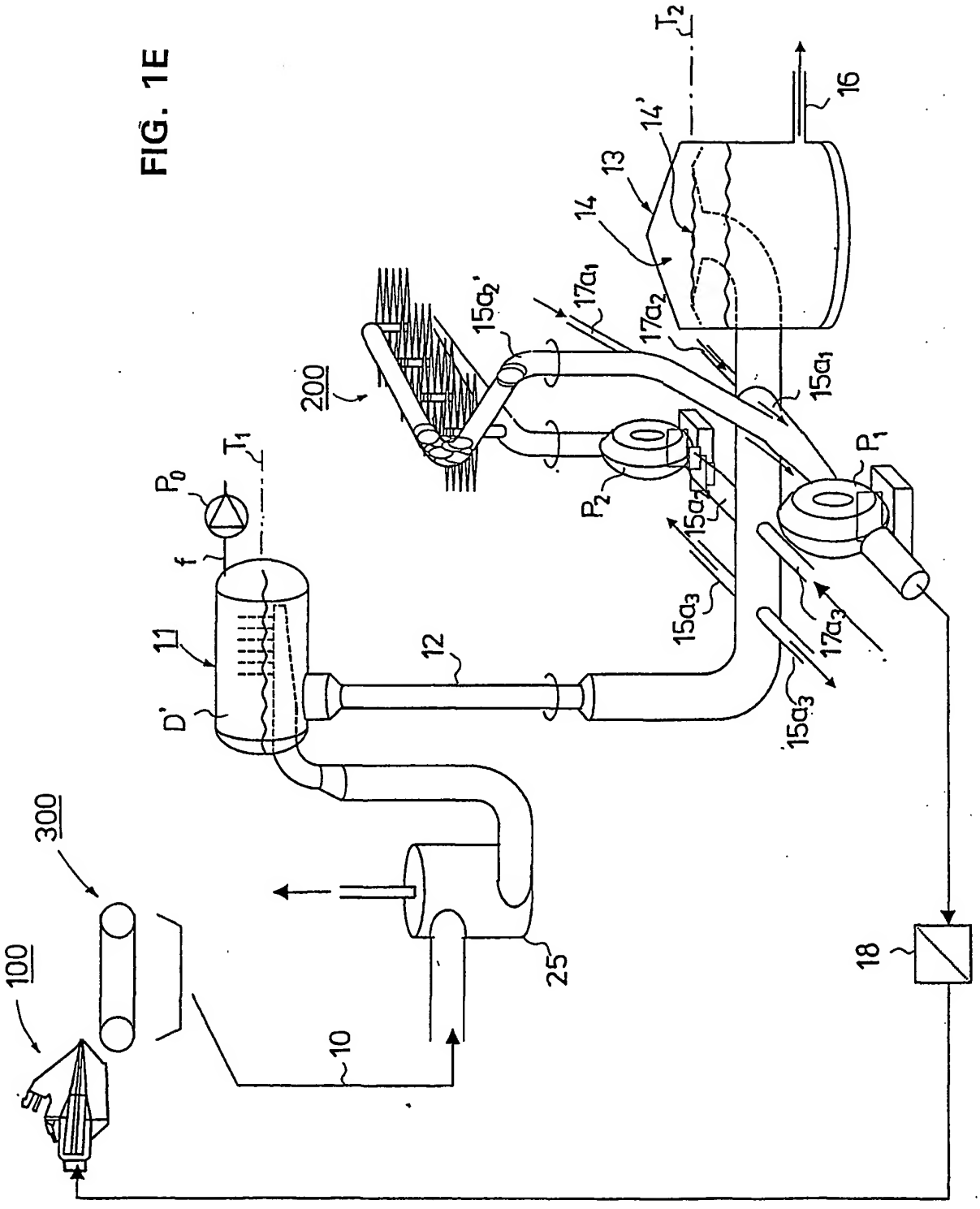
thick stock
P_2
200

FIG. 1E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$17a_3$

INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER

IPC7: D21D 5/26, D21F 1/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: D21D, D21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4443232 A (ROBERT G. KAISER), 17 April 1984 (17.04.84), column 20, line 12 - line 41, figure 11 -- --------	1

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
26 March 2002	09 -04- 2002
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Olov Jensén/ELY Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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